ME 316: Systems Design

Course description:	Systems and component design; product development from specifications to manufacturing; team-based CAD design projects; engineering economics; engineering professional skills.
Number of credits:	3
Course Coordinator:	C. Pezeshki
Prerequisites by course:	CE 215; ME 216; certified major in Mechanical Engineering, Materials Science and Engineering, Civil Engineering, or Electrical Engineering
Prerequisites by topic:	1. Applications of CAD in Engineering Design and Analysis 2. Mechanics of Materials 3. Dynamics
Postrequisites:	ME 416
Textbooks/other required materials:	1. Olivier de Weck, D. Roos, and C.L. Magee, Engineering Systems: Meeting Human Needs in a Complex Technological World, 2nd Edition, 2011, MIT Press. 2. Sepulveda, Souder, & Gottfried, Schawm's Outline for Engineering Economics, 1984, McGraw-Hill. 3. Paradis & Zimmerman, The MIT Guide to Science and Engineering Communication: Second Edition, 2002, MIT Press. 4. National Society of Professional Eng. Board of "Ethical Review Cases" http://www.nspe.org/resources/ethics/ethics-resources/board-of-ethical-review-cases
Course objectives:	1. To understand the engineering design process and the engineering decision making process. 2. To understand how modern CAD systems are used in a team-based engineering design process. 3. To understand the basic concepts of engineering economics and using engineering economics in the decision making process. 4. To use effective communication methods to present and convey design and engineering information. 5. To understand the importance of professional and ethical responsibility. 6. To understand group dynamics and to learn to work effectively in groups. 7. To be familiar with engineering codes and standards. 8. To gain engineering design experience incorporating engineering knowledge and skills, engineering standards and codes, and multiple realistic constraints.
Topics covered:	1. Engineering design process. 2. Engineering decision making process. 3. Product life cycle management (PLM). 4. Geometric Dimensioning and Tolerancing (GD&T) 5. Engineering Economics (time value of money; cost including incremental, average, sunk, and estimating; economic analysis; depreciation). 6. Engineering communications – writing and presentations. 7. Professional and ethical responsibility (codes of ethics; agreements and contracts; ethical and legal considerations; professional liability; public health, safety, and welfare). 8. Engineering standards and codes. 9. Contemporary issues in engineering design. 10. Societal and global issues. 11. Planning and executing design projects incorporating appropriate engineering standards and meeting multiple realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

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Expected student outcomes:

1. Be able to use CAD tools in the design process.
2. Be able to manage design configurations through the product development.
3. Understand the basics of geometric dimensions and tolerances to designs.
4. Be able to use the basic concepts of engineering economics to aid in design decision making.
5. Be able to use correct style and format in formal and informal methods of engineering communication.
6. Gain hands-on experience on project planning and execution.
7. Gain hands-on experience on how a team can use the engineering design process to carry out a project; as a member of a team, complete a design project to a finished, functional design.
8. Understand the importance of professional and ethical responsibility, contemporary issues, and global and societal impact of engineering decisions.
9. Understand the basic concepts of and be able to identify and apply appropriate engineering standards and codes in the design process.
10. Gain engineering design experience incorporating engineering knowledge and skills-engineering standards and codes, and multiple realistic constraints.

Class schedule: Three 50-minute lecture sessions per week, for one semester.

Laboratory schedule: Lecture sessions converted to laboratory sessions as needed for CAD and design activities.

Contribution to meeting the professional component: Engineering Topics

Relationship of course to program objectives: Meets:

1. School of MME ME educational objectives: 1, 2, 3
2. School of MME ME program outcomes: (a), (c), (d), (e), (f), (g), (h), (i), (j), (k)
3. ABET EC2000, Criterion 3 program outcomes: (a), (c), (d), (e), (f), (g), (h), (i), (j), (k)

Prepared by: C. Pezeshki *Date:* November 5, 2014

POLICIES

A. **Reasonable Accommodation** (the nature of the particular course determines which one applies): • Pullman Campus. Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. • WSU Online Course. Reasonable accommodations are available in online classes for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend you begin the process as soon as possible. For more information contact a Disability Specialist on your home campus: Pullman or WSU Online (http://accesscenter.wsu.edu), Spokane (http://spokane.wsu.edu/students/current/studentaffairs/disability/), Tri-Cities (http://www.tricity.wsu.edu/disability), Vancouver (http://studentaffairs.vancouver.wsu.edu/student-resource-center/disability-services).

B. **Academic Integrity:**
WSU expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Students are expected to uphold these standards both on and off campus and acknowledge the university's authority to take disciplinary action. The Standards of Conduct for Students found at http://conduct.wsu.edu.

C. **WSU Safety:**
WSU is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a Campus Safety Plan, http://safetyplan.wsu.edu. It is highly recommended that you visit this web site as well as the University emergency management web site at http://oem.wsu.edu/ to become familiar with the information provided.

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Specifics for Spring 2014 Section 2

MEETING TIME AND LOCATION: EME 154, M,W,F 3:10 - 4 PM
INSTRUCTOR: Dr. Jacob Leachman, Office: Sloan 217, Phone: 509-335-7711, e-mail: jacob.leachman@wsu.edu
TA: Yang Hu, e-mail: yang.hu@email.wsu.edu
GRADING: Standard WSU grade distribution applies, Design 1: 40%, Design 2: 40%, General Assignments: 20%.

SCHEDULE: *the class schedule topics & order may change during the semester based on need

Day		Lecture Topic	Readings
Jan 12	Product/Component Design	1. Introduction to Systems Design	
Jan 14		2. Understanding needs- the key to developing goals & product pitches	Communication-1,2
Jan 16		3. The role of art in design + Design 1 kickoff	
Jan 19		Martin Luther King Jr Day--ALL UNIVERSITY HOLIDAY	
Jan 21		4. Design Theme and the House of Quality	
Jan 23		5. Subsystem allocation and file sharing	
Jan 26		6. Literature reviews and design standards	Communication-3,17
Jan 28		7. Context, Coherence, and product specification development	Communication-6
Jan 30		8. Design visualization and GD&T Standards	
Feb 2		9. Design/product Technology Readiness Levels (TRL)	
Feb 4		10. Concept proposal development	Communication-8
Feb 6		11. Design 1 proposal presentations	
Feb 9		12. Design 1 presentation review	Econ-1,2,4
Feb 11		13. Estimating Costs & Interest: incremental & periodic compounding	Econ-4,5
Feb 13		14. Estimating Costs & Interest: discrete & continuous compounding	
Feb 16		President's Day—CLASS HOLIDAY	
Feb 18		15. Equivalence: Present vs. future worth	Econ-6,7,8
Feb 20		16. Payback, rate of return, & benefit/cost ratio in equipment selection	Econ-8,10
Feb 23		17. Justifying investment decisions & Bill of Materials (BOMs)	Econ-9,12
Feb 25		18. Necessity of revision & iteration in design	Communication-4
Feb 27		19. Report development	Communication-10
Mar 2		20. Presentations that pop	Communication-5,14
Mar 4		21. Presentation preparation and practice	
Mar 6		22. Design 1 class presentations	
Mar 9	Systems Design	23. From inventions to systems	Systems-1,2
Mar 11		24. The WALL + Design 2 kickoff	
Mar 13		25. (Open)	
Mar16-20		**Spring Break**	
Mar 23		26. Identifying system structures & defining context	Systems-3
Mar 25		27. System behavior: stocks, flows, & feedback loops	
Mar 27		28. Tools for system design and analysis	Systems-5
Mar 30		29. Considering the –ilities in a system life-cycle	Systems-4
Apr 1		30. Design/product life-cycle analysis	
Apr 3		31. Design 2 proposal presentations/review	
Apr 6		32. Design/product sustainability analysis	
Apr 8		33. Continual evolution of systems	Systems-6
Apr 9		34. Case studies in systems behavior	
Apr 13		35. Ethical case studies in design: currency of standards	Ethics-2.5
Apr 15		36. Ethical case studies in design: delegating understanding	Ethics-9.8
Apr 17		37. Ethical case studies in design: sustainable development	Ethics-7.6
Apr 20		38. Engineering systems research	Systems-7
Apr 22		39. Nature inspired systems & flow	
Apr 24		40. Social networks and systems for innovation	
Apr 27		41. Engineering the curriculum	
Apr 29		42. Presentation preparation and practice	
May 1		43. Design 2 class presentations	